PATENT SPECIFICATION

DRAWINGS ATTACHED

907,927

Date of Application and filing Complete Specification May 1, 1961.

No. 15756/61.

Application made in United States of America (No. 38826) on June 27, 1960.

Complete Specification Published Oct. 10, 1962.

Index at acceptance: —Class 108(2), D6C.

International Classification: —B62d.

COMPLETE SPECIFICATION

Improvements in or relating to Suspension Systems for Trailer Vehicles

We, FRUEHAUF TRAILER COMPANY, a Corporation organized and existing under the Laws of the State of Michigan, United States of America, of 10940 Harper Avenue, Detroit 23, Michigan, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates generally to wheeled trailers and more particularly to improved suspension systems for adjustably coupling the wheel bogie of a trailer to the body thereof.

It is often desirable to adjust the wheel bogie of a trailer longitudinally of the trailer body so that the total weight of the trailer can be suitably apportioned between the bogie wheels and the wheels of a tractor vehicle coupled to the trailer. A proportionally greater load is transferred to the trailer wheels as the wheel bogie is moved forwardly under the trailer body and, conversely, a proportionally greater load is transferred to the tractor wheels as the wheel bogie is moved rearwardly of the trailer body. Such a change may be required by regulations governing the loading of vehicles in different states or countries.

It has been the practice, in adjustable trailer wheel suspensions heretofore known and used, slidably to support the trailer body for movement relative to the wheel bogie on a longitudinally extending frame that surmounts the wheel bogie. Generally, the longitudinal frame members of the trailer body are provided with depending vertical flanges that extend alongside the bogie frame to guide the relatively moving components during adjustment and to facilitate locking of the wheel bogie to the trailer body as by suitable bolts that extend laterally through the downwardly extending flanges and into the bogie frame.

The aforementioned prior constructions have proved to be unsatisfactory in that rust, ice, dirt and the like tend to impede adjustment of the wheel bogie with respect to the trailer body. Because it is the practice to first set the brakes on the wheel bogie and then shift the trailer body with respect to the wheel bogie by using the tractor to move the trailer body forwardly or rearwardly of the wheel bogie, any impedance to relative movement between the trailer body and the wheel bogie may have a deleterious effect on the tractor clutch or transmission, particularly if the trailer is heavily loaded.

An object of the present invention is to reduce the effect of the above disadvantages by providing for the trailer body to be lifted and supported on antifriction means during longitudinal adjustment of the wheel bogie and trailer body.

According to the invention there is provided an adjustable suspension system for a trailer including a wheel bogie and a trailer body, said suspension system comprising means for normally restricting relative longitudinal movement between the wheel bogie and the trailer body and means including anti-friction means operable concurrently to disengage the means restricting relative longitudinal movement and interpose the anti-friction means between the wheel bogie and the trailer body to facilitate relative movement therebetween. Preferably the means for restricting relative movement of the wheel bogie and trailer body comprises downwardly depending index means on the trailer body engageable with upwardly extending index means on the bogie. These index means may conveniently comprise coacting sets of spaced teeth mounted on a rail extending longitudinally of and secured to the trailer body

[*Price ~~4s. 6d.~~*]

and on seats on the bogie adapted to receive and support the rail.

In its preferred form the present invention is directed to an adjustable suspension system comprising a lift mechanism mounted on the wheel bogies and operable to concurrently disengage a locking means between the wheel bogie and trailer body and to engage a plurality of anti-friction rollers with a complementary rail on the trailer body to facilitate relative movement therebetween. When the rollers are disengaged from the rail, the lock is automatically engaged to preclude relative longitudinal movement between the wheel bogie and trailer body. The wheel bogie is locatable at relatively small increments with respect to the trailer body.

Preferably the rail engaging rollers are each carried at one end of an arm pivoted to the bogie, a retainer plate mounted on the arm being provided with a flange engageable with a flange on the rail to hold in engagement the means for preventing relative longitudinal movement of the bogie and the trailer body. Desirably a cam is engageable with two vertically spaced surfaces on the arm, engagement with one surface upon rotation of the cam in one direction causing the roller to be raised to engage and lift the rail and the flanges to be disengaged to permit relative movement of the bogie and the trailer body, and engagement with the other surface upon rotation of the cam in the opposite direction causing the roller to disengage from the rail and the flanges to engage each other to prevent relative longitudinal movement of the bogie and trailer body.

In an alternative arrangement the rollers may be each be mounted on a journal arranged eccentrically of an operating shaft extending transversely of the bogie, rotation of the shaft causing the roller to raise or lower the rail relative to the bogie. The shaft may be rotatable by power means, such as a pneumatic actuator, having an output shaft engageable with a crank extending from the operating shaft; alternatively, the output shaft may be provided with a rack engaging a spur gear secured to the operating shaft.

The present invention will be described, merely by way of example with reference to the accompanying drawings, wherein:—

Figure 1 is a side elevation of a tractor, trailer body and wheel bogie in operative association;

Figure 2 is a fragmentary side elevation of the wheel bogie of the trailer of Figure 1, enlarged for clarity;

Figure 3 is a fragmentary perspective view of the wheel bogie taken in the direction of the arrow "3" of Figure 2;

Figure 4 is a fragmentary cross-sectional view taken substantially along the line 4—4 of Figure 3;

Fgure 5 is a cross-sectional view similar to Figure 4, showing the lift mechanism in the elevated condition;

Figure 6 is a cross-sectional view taken substantially along the line 6—6 of Figure 4;

Figure 7 is a cross-sectional view taken substantially along the line 7—7 of Figure 4;

Figure 8 is a fragmentary side elevation of the lift mechanism of Figure 4 taken in the direction of the arrow "8";

Figure 9 is an end view of a modified lift mechanism;

Figure 10 is a fragmentary cross-sectional view taken substantially along the line 10—10 of Figure 9;

Figure 11 is a fragmentary cross-sectional view taken substantially along the line 11—11 of Figure 10;

Figure 12 is a fragmentary top view of the lift mechanism of Figure 9, and

Figure 13 is a fragmentary cross-sectional view similar to Figure 11 of a modified hydraulic actuator for a lift mechanism.

Referring to the drawings, an adjustable suspension system 10 comprises means for adjustably mounting a wheel bogie 11 beneath trailer body 12 of a trailer 13. The suspension system 10 adjustably couples the wheel bogie 11 to the trailer body 12, the trailer 13 being connected to a tractor 14, in the conventional manner, as by a fifth wheel 16.

The wheel bogie 11 has a pair of longitudinally extending frame members 22 and 24 interconnected by a plurality of transversely extending bolsters 26, 28 and 30. A plurality of conventional spring support brackets 31 extend downwardly from the bolsters 26, 28 and 30 at appropriate locations thereon for the support of conventional springs 32, axles 34, and road wheels 36. The wheel bogie 11, including the aforementioned components, is a self-sustaining unit and, as such, is disengageable from the trailer body 12, in a manner to be described.

The adjustable suspension system 10 comprises a plurality of lift mechanisms 50 supported within the bolsters 26, 28 and 30, one lift mechanism 50 being disposed at each outboard end of the bolsters 26, 28 and 30, respectively. The lift mechanisms 50 function to elevate a like plurality of anti-friction rollers 52 into engagement with a complementary rail 54 that is affixed to and extends longitudinally of the trailer body 12, in a manner to be described. Because the lift mechanisms 50 are similar in construction, only one will be described hereinafter, namely, the lift mechanism 50 associated with an outer end 55 of the bolster 28.

Each lift mechanism 50 comprises an arm 60, for example, a steel casting, having a generally inverted U-shape when viewed in vertical cross-section, that is pivotably supported at an inner end 62 by a pin 63 that is secured to the bolster 28, as by welding. The inner end portion 62 of the arm 60 extends

upwardly through an aperture 64 in a top plate 65 of the bolster 28. The arm 60 has a generally vertically extending end face 66 at an outer end 67 thereof from which a generally horizontal roller journal 68 extends for the support of the roller 52.

The roller 52 has a suitable sleeve bearing 69 disposed in a bore 70 thereof to reduce friction between the roller 52 and the journal 68. A thrust-bearing 71 and a plurality of shim washers 72 are interposed between the roller 52 and the end face 66 of the arm 60 to position and reduce friction of the roller 52 with respect to the arm 60. The roller 52 is retained on the journal 68 by an end plate 73 that is secured to the journal 68 by a machine screw 74.

The arm 60 is rotatively biased about the pivot pin 63 by a cam lever 80. The cam lever 80 is supported for rotation by a shaft 84, and is fixedly secured thereto by a set screw 85. The shaft 84 extends through an elongated arcuate slot 86 in the arm 60 and is journalled in suitable axially spaced bearings 87 and 88 that are secured to opposite side walls 89 and 90 of the bolster 28. The bearings 87 and 88 are provided with suitable bearing inserts 91 and 92 to facilitate rotation of the shaft 84 with respect to the bolster 28. Suitable caps 93 and 94 close the side walls 89 and 90 of the bolster 28 against the infiltration of foreign materials.

The cam lever 80 has an upper cam face 95 thereon that is engageable with a roller 96 that is supported in a pair of axially spaced bearings 97 and 98 in the arm 60. The cam face 95 has a contour that is so oriented with respect to the cam shaft 84 that, upon clockwise rotation of the cam lever 80, the cam face 95 biases the roller 96, and therefore the arm 60 and wheel 52, upwardly to the position shown in Figure 5.

A lower cam face 100 on the cam lever 80 is engageable with a lower cam surface 101 on a lower end 102 of the arm 60. The contour and orientation of the cam face 100 is such that it permits free movement of the arm 60 upwardly under the bias of the cam face 95 upon clockwise rotation of the cam lever 80, yet is engageable with the cam surface 101 to bias the arm 60 downwardly upon counterclockwise rotation of the cam lever 80. The rotational position of the arm 60 is thus under positive control of the cam lever 80 at all times and is locked in a lower position when the cam lever 80 is biased counterclockwise to its normal position shown in Figure 4.

The cam lever 80 has a downwardly extending arm 104 having a transverse pin 105 therein to facilitate connection of the cam lever 80 to a piston 106 of a pneumatic actuator 108. The actuator 108 is of conventional construction and is secured to the bolster 26 by a support 109. A suitable conduit 110 connects the actuator 108 to a source of fluid pressure.

A helical coil spring 111 extends between the pin 105 and an aperture 112 in the upper end portion 62 of the arm 60 to bias the cam lever 80 counterclockwise with respect to its pivotal support 84 and to retract the piston 106 into the actuator 108.

The rail 54 has a vertical flange 120 and a horizontal flange 122, adapted to be attached to the lower outboard edge of the trailer body 12, by any suitable means. The rail 54 has a downwardly depending rib portion 124 with a horizontally extending flange or gooseneck 125 thereon, an upper face 126 of which is engageable with a complementary lower face 127 on a horizontally extending flange or gooseneck 128 on the roller retainer plate 73. The aforementioned engagement of the flanges 125 and 128 biases the trailer body 12 downwardly with respect to the bolster 28 upon downward movement of the arm 60, as will be described.

As best seen in Figures 4, 7 and 8, the rail 54 is normally seated in a complementary way 150 in an upper end portion 152 of a bolster end bracket 154. The end bracket 154 has a central aperture 156 for the acceptance of the roller 52 and is rigidly affixed to an outer end 157 of the bolster 26, as by welding. The bracket 154 has a pair of generally radial extensions 158 and 159 with a pair of spaced upwardly extending flanges 160 and 162 thereon that define the way 150. The innermost flange 162 has a plurality of longitudinally spaced teeth or serrations 166 thereon that are engageable with complementary downwardly extending serrations 168 on an index plate 170 that is secured to the rail 54, as by welding.

In order to adjust the wheel bogie 11 longitudinally with respect to the trailer body 12 the driver first energizes air brakes on the wheels 36 of the wheel bogie 11. The pneumatic actuator 108 is then energized to pivot the cam lever 80 in a clockwise direction to engage the cam face 95 thereof with the roller 96. As the cam lever 80 rotates clockwise, the roller 96 rides up on the cam face 95, biasing the arm 60 clockwise about its pivot 63. As best seen in Figure 5, the first increment of clockwise rotation of the arm 60 disengages the gooseneck 128 on the plate 73 from the gooseneck 125 on a rail 54 and effects engagement of the roller 52 with the downwardly depending rib 124. As the arm 60 continues to rotate clockwise, the wheel 52 lifts the rail 54 and trailer body 12 sufficiently to disengage the interlocking teeth 166 and 168. The operator then shifts the trailer body 12 with respect to the wheel bogie 11, as by driving the trailer forwardly or rearwardly. The wheel bogie 11 remains stationary because the brakes on the wheels 36 are set, the body 12 moving freely relative to

the wheel bogie 11 on the rollers 52. As the arm 60 raises the trailer body 12 any rust or dirt that otherwise might tend to hold the trailer body 12 on the wheel bogie 11 is broken away.

After the longitudinal adjustment has been made, the actuator 108 is de-energized whereupon the weight of the trailer 12 biases the arm 60 counterclockwise and the spring 111 biases the cam lever 80 counterclockwise. As the arm 60 rotates counterclockwise, the rail 54 settles into the way 150 and the teeth 166 and 168 re-engage.

It is to be noted that during the final increment of rotation of the cam lever 80, the lower cam face 100 thereof engages the cam surface 101 on the arm 60 to bias the arm downwardly and bring the locking goosenecks 125 and 126 into clamping engagement, whereupon the trailer body 12 is securely locked to the wheel bogie.

Referring to Figures 9 to 12, a plurality of modified lift mechanisms 300 are adapted to be mounted internally of the cross bolsters 26, 28 and 30, one such lift mechanism 300 being provided at the outboard end of each bolster 26, 28 and 30, respectively. For the purpose of clarity, the lift mechanism 300 is shown operatively associated with the bolster 28, referred to hereinbefore.

Each lift mechanism 300 comprises an end casting 302 that is bolted to complementary flanges 303 on the end of the bolster 28. The casting 302 has an aperture 304 therein for the acceptance of a suitable bearing 306, for example a bronze sleeve bearing. A rotatable operating shaft 310 having an eccentric 312 coupled thereto as by a pin 314, extends longitudinally of the bolster 28 for the operation of the lift mechanism 300, as will be described. The eccentric 312 has a tubular inner end portion 316 for the acceptance of an end portion 318 of the shaft 310. The eccentric 312 has a radial flange 320 and a wheel journal 322 that position and support a wheel 324, respectively. The wheel 324 is engageable with the rail 54 on the trailer body 12, as will be described. As best seen in Figure 12, the central axis of the wheel journal 322 is radially displaced from the central axis of the tubular portion 316 and shaft 310.

A forked toggle handle 330 is pivotally supported on a hollow pin 332 that extends through an aperture 333 in an outwardly projecting flange 334 on the end casting 302. A lower end portion 336 of the toggle handle 330 is formed so as to provide a handle to facilitate movement thereof. A clamp 340 is pivotally supported for rotation with respect to the toggle handle 330 by a pin 342 that extends through suitable apertures 344 and 346 in the clamp 340 and an aperture 348 in the toggle handle 330. Movement of the toggle handle 330 about its hollow pivot pin 332 moves the clamp member 340 upwardly and downwardly with respect to the end casting 302 thereby to disengage and engage, respectively, a flanged upper end portion 350 of the clamp 340 with the complementary flange or gooseneck 124 on the rail 54 of the trailer body 12. A lower end portion 360 of the clamp 340 is engageable with an adjustable stop 362 to define an over-centre position for the pin 342 with respect to a line drawn between the central axis of the hollow pin 332 and the point of engagement between the complementary flanges 350 and 124 on the clamp 340 and rail 54, respectively. The clamp 340 has a pair of bores 364 and 366 extending therethrough for the acceptance of a lock pin 370. The lock pin 370 is insertable through the bores 364 and 366 and through the centre of the hollow pivot pin 332 thereby to lock the clamp 340 in the over-centre position with respect to the toggle handle 330 and end casting 302. The locking pin 370 is secured in the assembled position by a pin 372 that is secured against loss as by a lanyard 374.

The end casting 302 has a seating surface 380 for the downwardly depending flange 124 on the side rail 54 of the trailer body 12 and a plurality of upwardly extending teeth 382 for engagement with the downwardly depending teeth 168 on the index flange 170 of the side rail 54. In this manner, the side rail 54 of the trailer body 12 can be positively positioned at relatively small increments longitudinally of the wheel bogie 11.

As best seen in Figure 11, rotation of the operating shaft 310 is effected by a crank 390 that is secured thereto by any suitable means, for example welding. The crank 390 has a transverse pin 394 at a lower end 396 thereof that is engageable in a complementary slot 398 of a yoke 400 on the end of an actuator shaft 402 of a pneumatic actuator 410. The actuator 410 is supported with respect to the transverse bolster 28 by a bracket 411.

Referring to Figure 13, a modified coupling between a pneumatic actuator 450 and the drive shaft 310 comprises a gear rack 452 having a plurality of teeth 454 thereon that is secured to the output shaft 402 of the actuator 450 as by a threaded connection. The gear rack 452 cooperates with a complementary spur gear 460 on the shaft 310 to effect rotation of the shaft 310 upon energization of the actuator 450. The actuator 450 is supported with respect to the bolster 28 by a bracket 464 that is secured to the bolster 28 by machine screws 468.

Elevation of the trailer body 12 with respect to the wheel bogie 11 is effected by actuation of the pneumatic actuator 410 or 450 after first moving the toggle handle 330 upwardly to disengage the clamp 340 from the rail 54.

Energization of the actuator 410 or 450

effects rotation of the operating shaft 310 which, because of the eccentric disposition of the journal 322 on the ends thereof, effects elevation of the wheels 324, rail 54 and trailer body 12. After the trailer body 12 is positioned longitudinally of the wheel bogie 11, the actuator 410 or 450 is de-energized, alowing the shaft 310 to rotate downwardly under the weight of the trailer body 12 to the position shown in Figure 10 wherein the lower end flange 124 on the rail 54 is seated on the way 380 of the end casting 302 and the teeth 168 of the locking flange 170 of the rail 54 are engaged in the complementary teeth 382 on the end casting 302. The goose-neck 350 of the clamp 340 is then re-engaged with the flange 124 of the rail 54 and the handle 330 is moved downwardly, or counter-clockwise, as seen in the drawing, about its pivotal support 332, until the pin 342 extending therethrough passes over-centre to a position defined by engagement of the end portion 360 of the clamp 340 with the adjustment screw 362. The toggle handle 330 and clamp 340 are locked in the downward position by insertion of the pin 370 through the aligned holes 364 and 366 in the clamp 340 and through the centre of the pivotal support 332 for the toggle handle 330.

WHAT WE CLAIM IS:—

1. An adjustable suspension system for a trailer including a wheel bogie and a trailer body, said suspension system comprising means for normally restricting relative longitudinal movement between the wheel bogie and the trailer body and means including anti-friction means operable concurrently to disengage the means restricting relative longitudinal movement and interpose the anti-friction means between the wheel bogie and the trailer body to facilitate relative movement therebetween.

2. A suspension system according to Claim 1, wherein the means for restricting relative movement of the wheel bogie and trailer body comprises downwardly depending index means on the trailer body engageable with upwardly extending index means on the bogie.

3. A susupension system according to Claim 2, wherein the index means on the trailer body and bogie comprise coacting sets of teeth.

4. A suspension system according to any preceding claim, which comprises a rail extending longitudinally of and secured to the trailer body, and seats on the bogie adapted to receive and support the rail.

5. A suspension system according to Claims 3 and 4, wherein the coacting sets of teeth are mounted on the rail and seats.

6. A suspension system according to any preceding claim, wherein the means restricting relative longitudinal movement of the body and the bogie are disengageable by the anti-friction means being moved relatively to the bogie to raise the trailer body.

7. A suspension system according to Claim 4 or 5, wherein the anti-friction means includes a roller carried by the bogie and movable into engagement with the rail on the trailer to support the trailer for movement relative to the bogie.

8. A suspension system according to Claim 4, 5 or 7, wherein means are provided for locking the rail against the seats.

9. A suspension system according to Claim 8, wherein power operated means are provided for unlocking the rail from the seats and lifting the rail relative to the bogie by the anti-friction means.

10. A suspension system according to Claim 7, wherein the rail engaging roller is carried at one end of an arm pivoted to the bogie.

11. A suspension system according to Claim 10, wherein a cam is provided engageable with the arm upon rotation in one direction to urge the latter upwardly to raise the roller relative to the bogie.

12. A suspension system according to Claim 11, wherein the cam is rotatable in the opposite direction to a position where it engages a portion of the arm to hold the roller in a lowered position disengaged from the rail.

13. A suspension system according to Claim 12, wherein a retainer plate mounted on the arm is provided with a flange engageable with a flange on the rail to hold in engagement the means for preventing relative longitudinal movement of the bogie and the trailer body.

14. A suspension system according to Claim 13, wherein the cam is engageable with two vertically spaced surfaces on the arm, engagement with one surface upon rotation of the cam in one direction causing the roller to be raised to engage and lift the rail and the flanges to be disengaged to permit relative movement of the bogie and the trailer body, and engagement with the other surface upon rotation of the cam in the opposite direction causing the roller to disengage from the rail and the flange to engage each other to prevent relative longitudinal movement of the bogie and trailer body.

15. A suspension system according to any one of Claims 11 to 14, wherein a spring is provided biasing the cam to a position in which the rollers are lowered and the rail is seated in the seats on the bogie.

16. A suspension system according to any one of Claims 11 to 15, wherein power operated means are provided for moving the cam in a direction to raise the rollers to lift the trailer body relative to the bogie.

17. A suspension system according to Claim 8, wherein the means for locking the

rail against the seats includes a toggle handle pivotally supported by the wheel bogie, and a clamp pivotally supported by the handle and engageable with the rail to lock the rail against the seats.

18. A suspension system according to Claim 17, wherein the toggle handle is movable to an over-centre position with respect to its pivotal axis and the point of engagement of the clamp and rail, a pin being insertable through the toggle handle and clamp for securing the handle in the over-centre position.

19. A suspension system according to Claim 7, 8, 17 or 18, wherein the roller is mounted on a journal arranged eccentrically of an operating shaft extending transversely of the bogie, rotation of the shaft causing the roller to raise or lower the rail relative to the bogie.

20. A suspension system according to Claim 19, wherein the shaft is rotatable by a pneumatic actuator having an output shaft engageable with a crank extending from the operating shaft.

21. A suspension system according to Claim 19 wherein the shaft is rotatable by a pneumatic actuator having an output shaft provided with a rack engaging a spur gear secured to the operating shaft.

22. A suspension system according to any preceding claim, wherein two rails are mounted on the bottom of the trailer body to be engageable with seats on the bogie and wherein the means for disengaging the means for preventing relative longitudinal movement of the bogie and trailer body comprises rollers mounted so as to be raisable to engage and lift the rails clear of the seats.

23. A suspension system for a trailer constructed and arranged substantially as herein described with reference to and as illustrated in Figures 1 to 8 of the accompanying drawings.

24. A suspension system for a trailer constructed and arranged substantially as herein described with reference to and as illustrated in Figures 9, 10, 11 and 12 of the accompanying drawings.

25. A suspension system according to Claim 24, modified as illustrated in Figure 13 of the accompanying drawings.

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Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1962.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

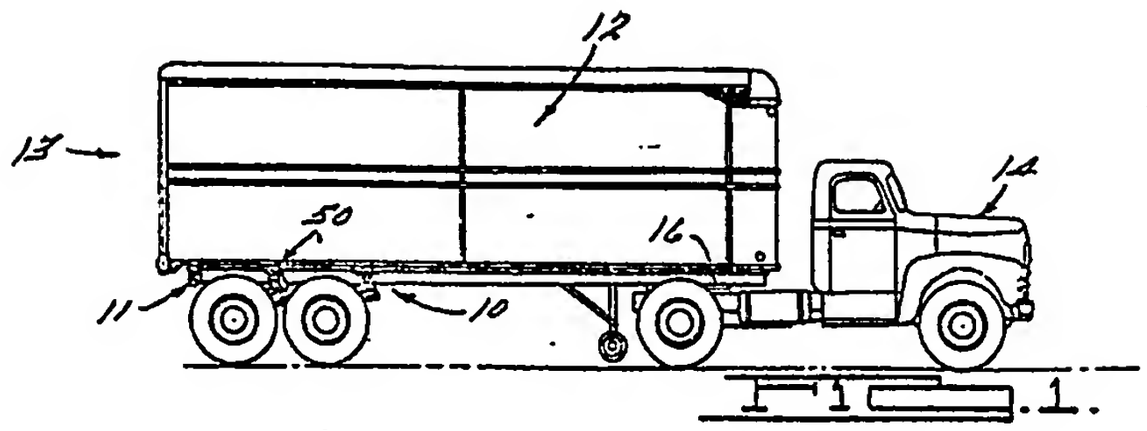


FIG. 1.

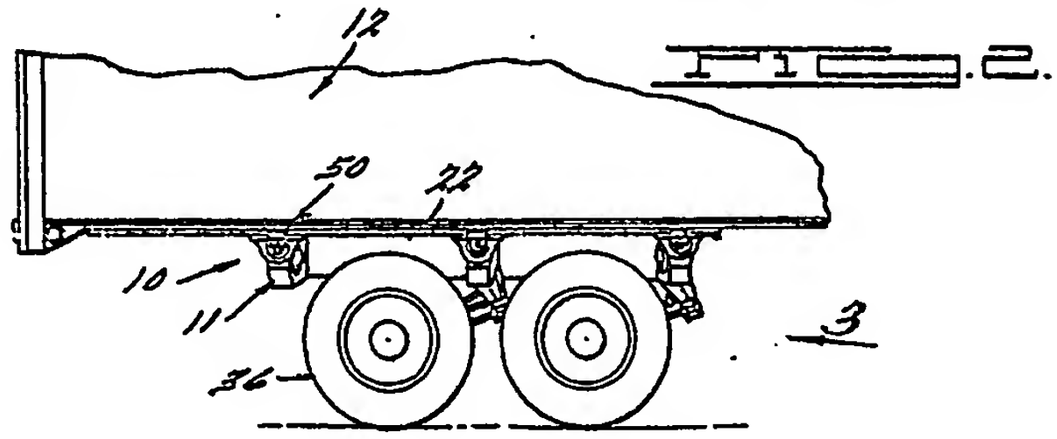
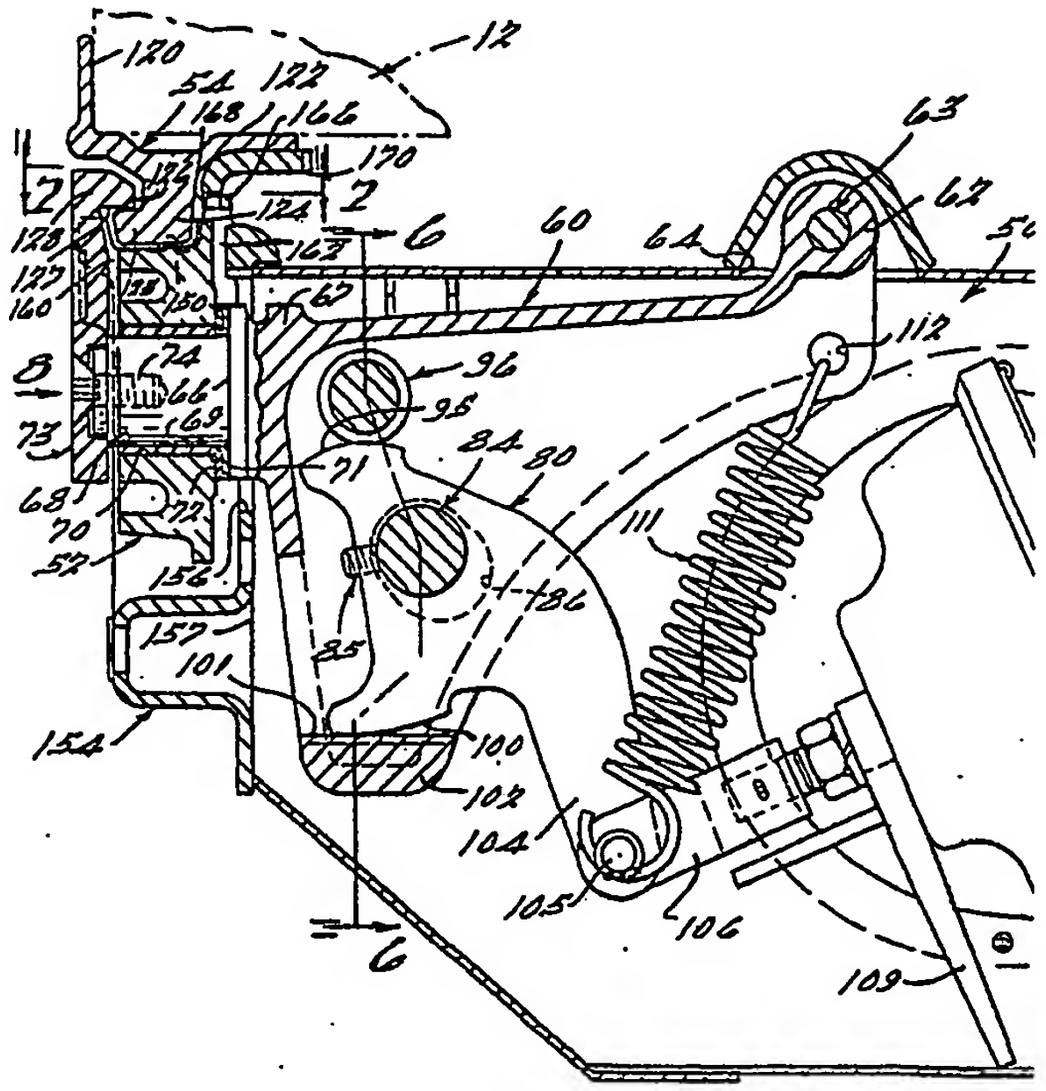


FIG. 2.

FIG



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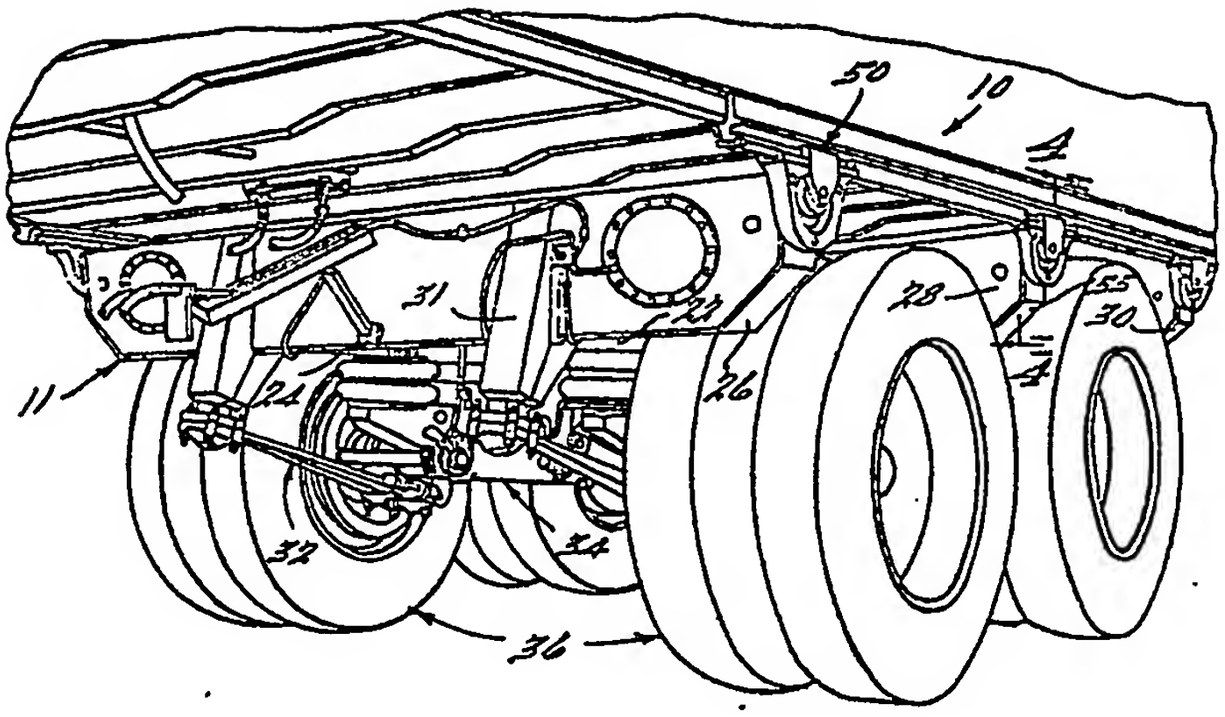

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FIG. 3.

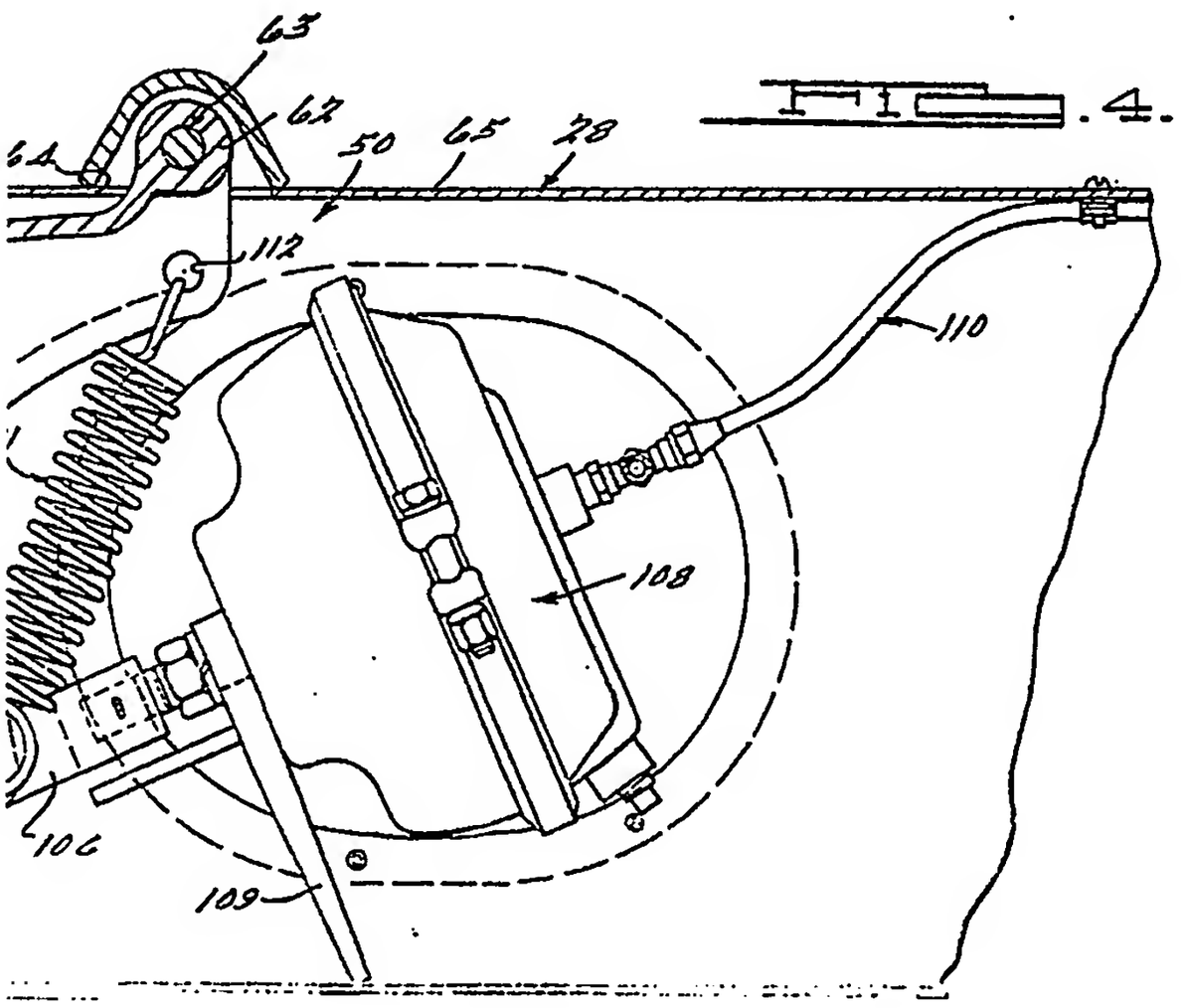

FIG. 4.

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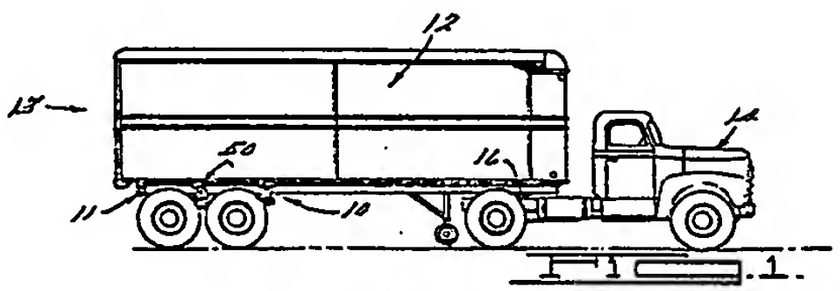


FIG. 1.

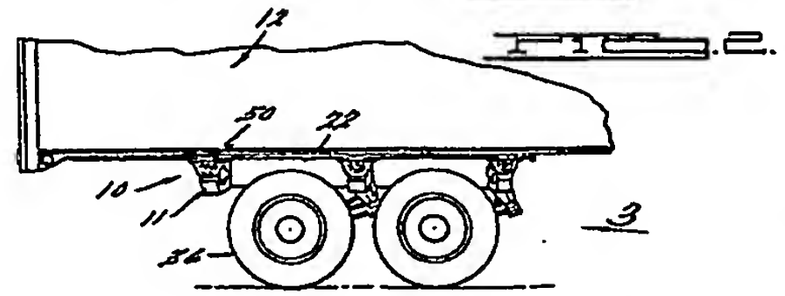


FIG. 2.

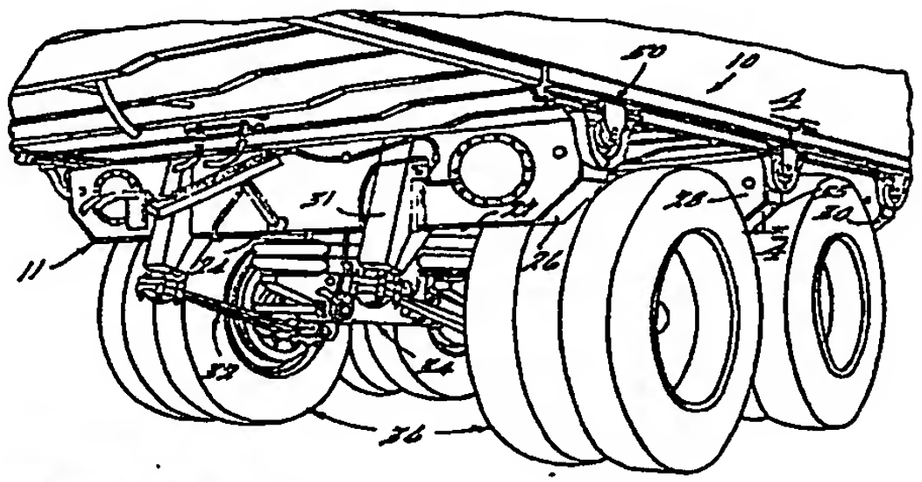


FIG. 3.

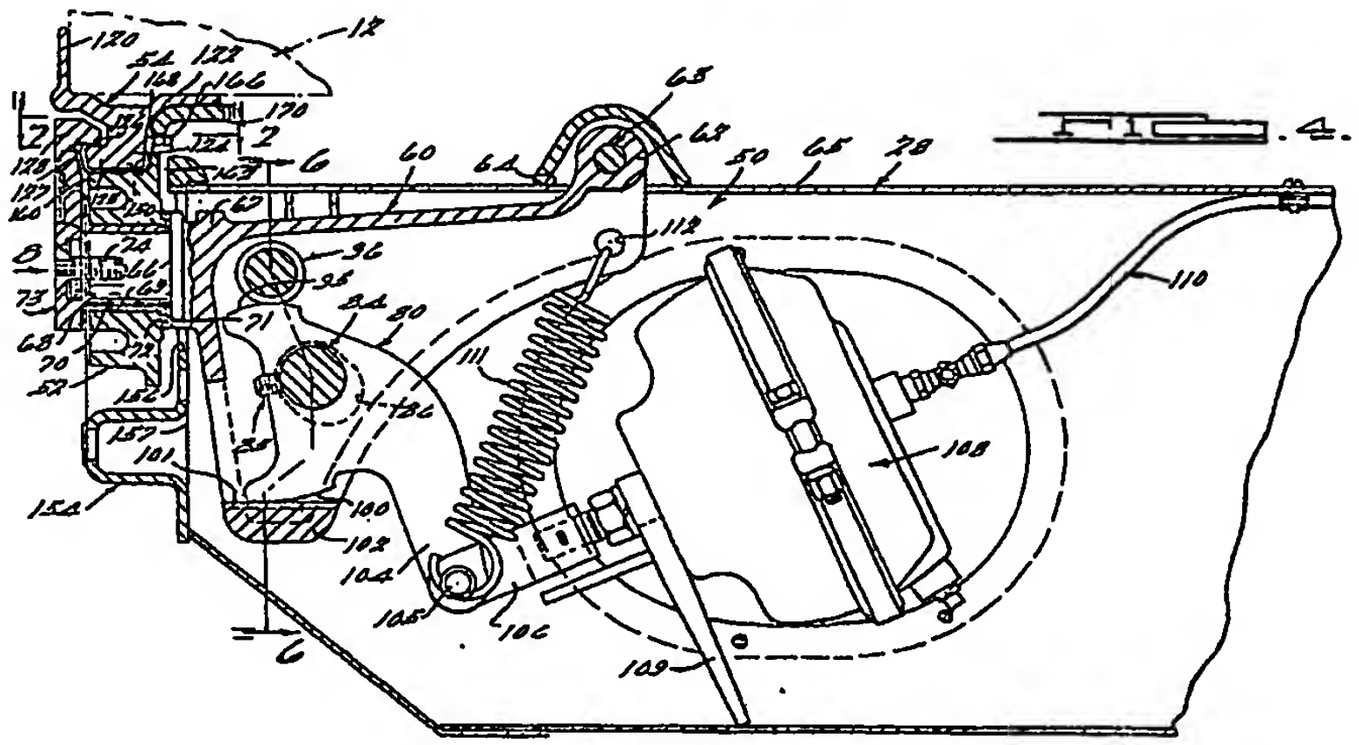
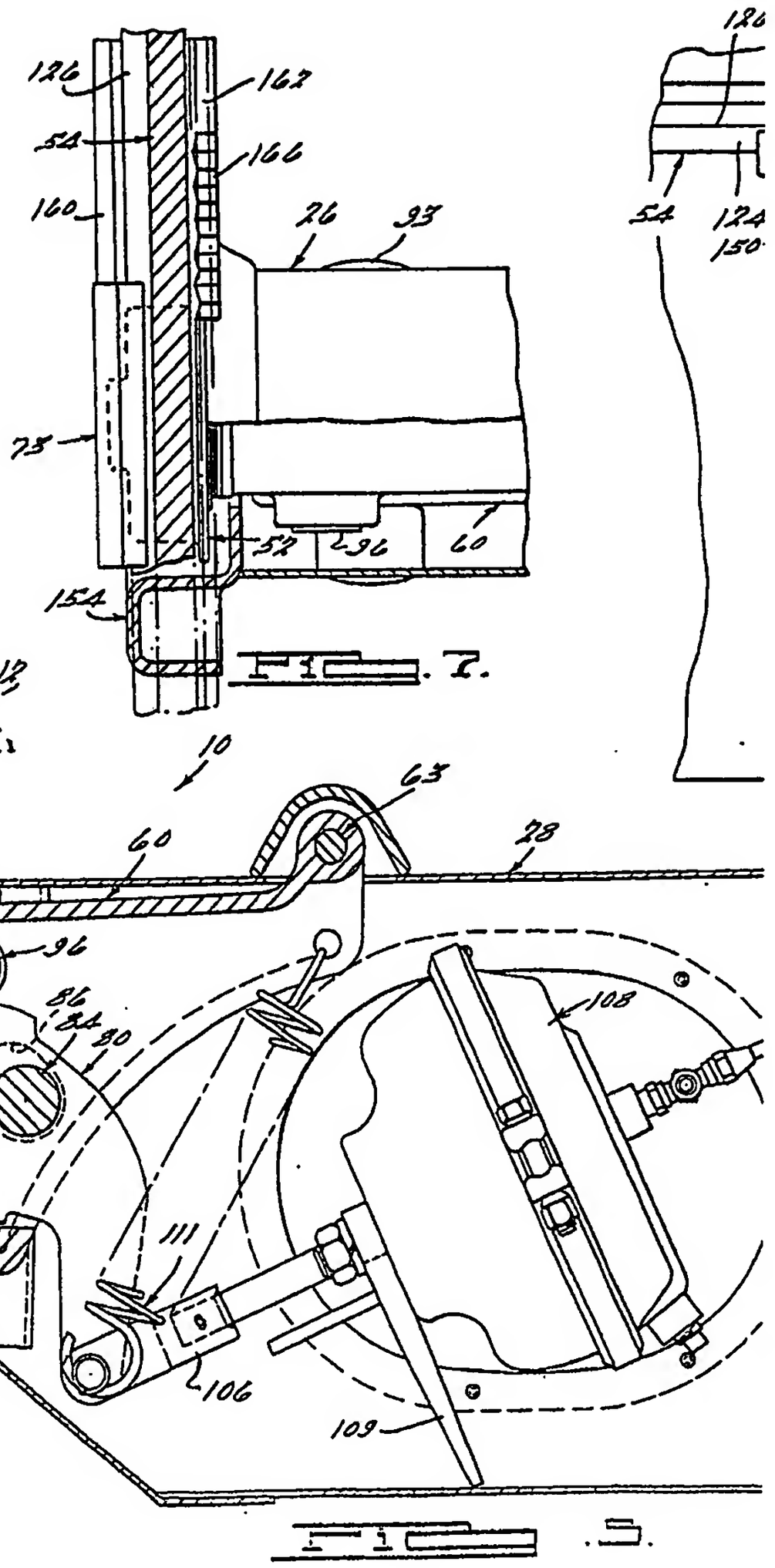


FIG. 4.


126
162
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150

FIG. 4.

12
128
54
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125
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168
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166
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109

FIG. 5.

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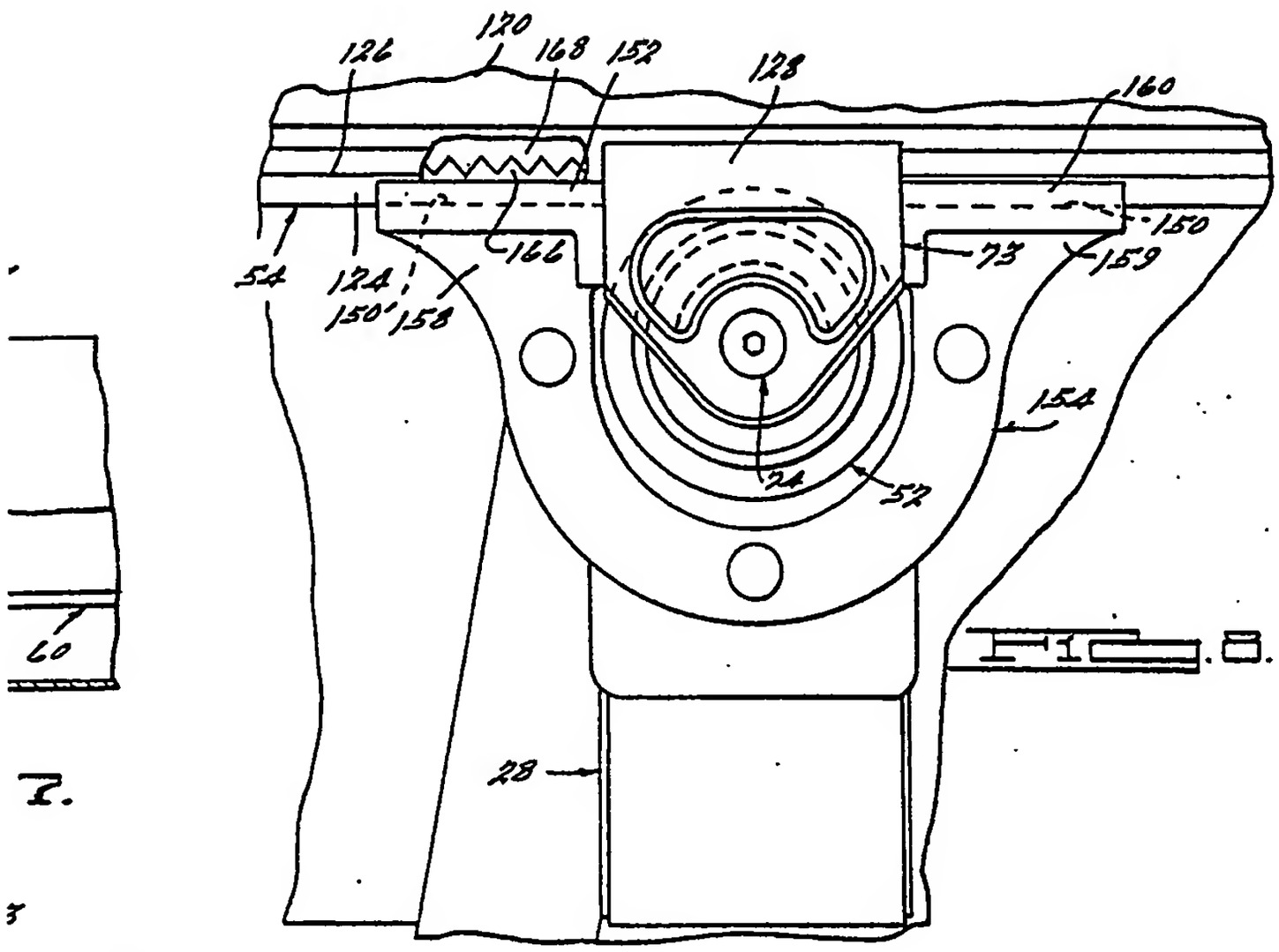
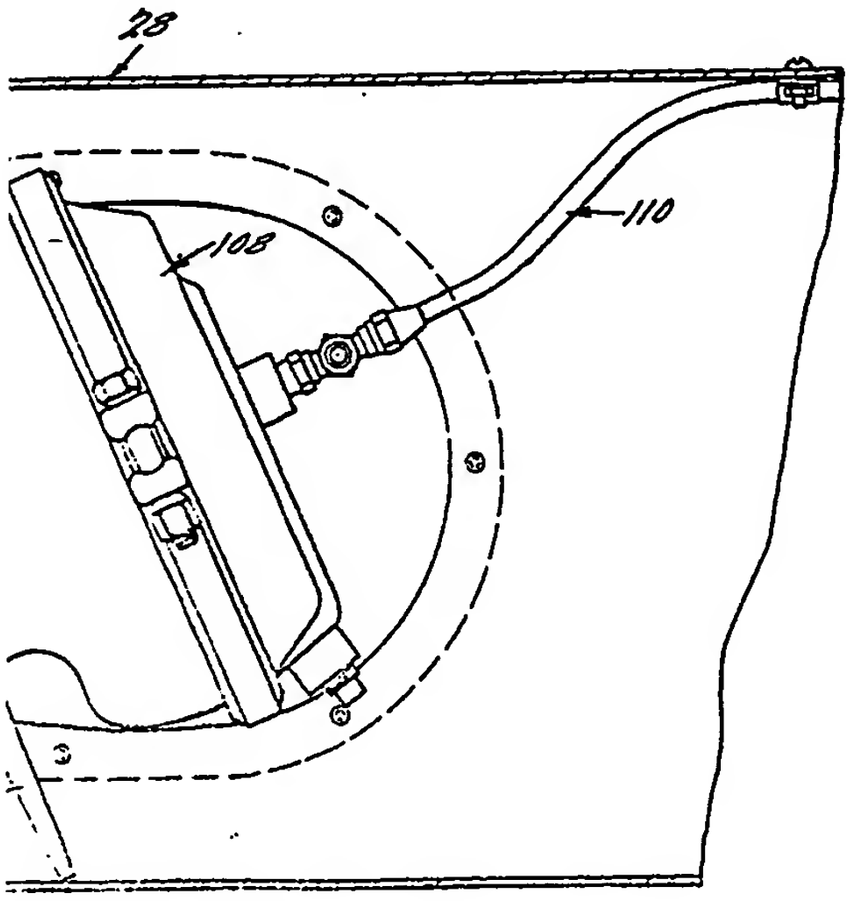


FIG. 5.



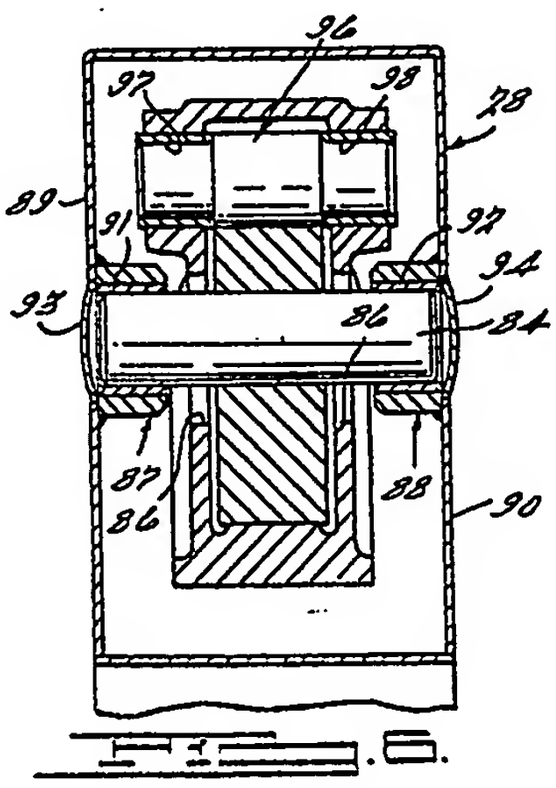


FIG. 6.

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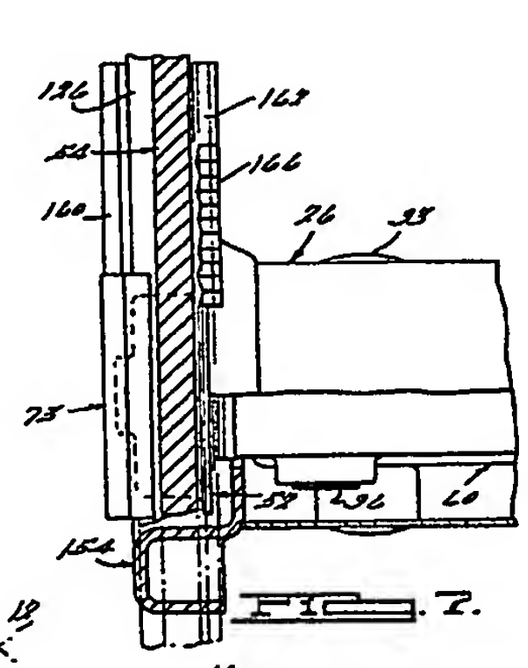

FIG. 7.

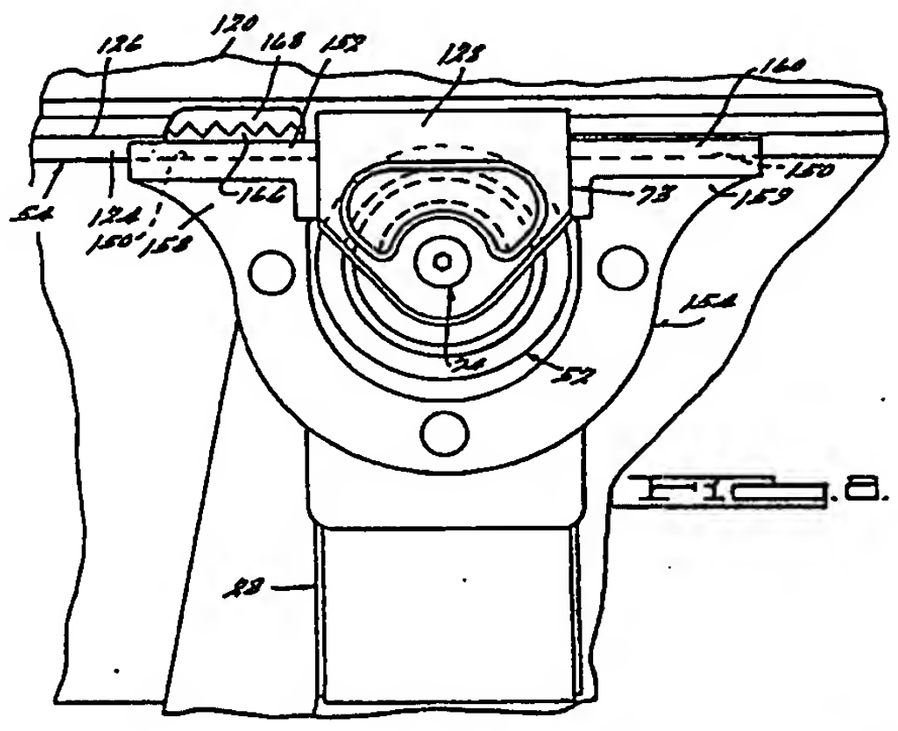

FIG. 8.

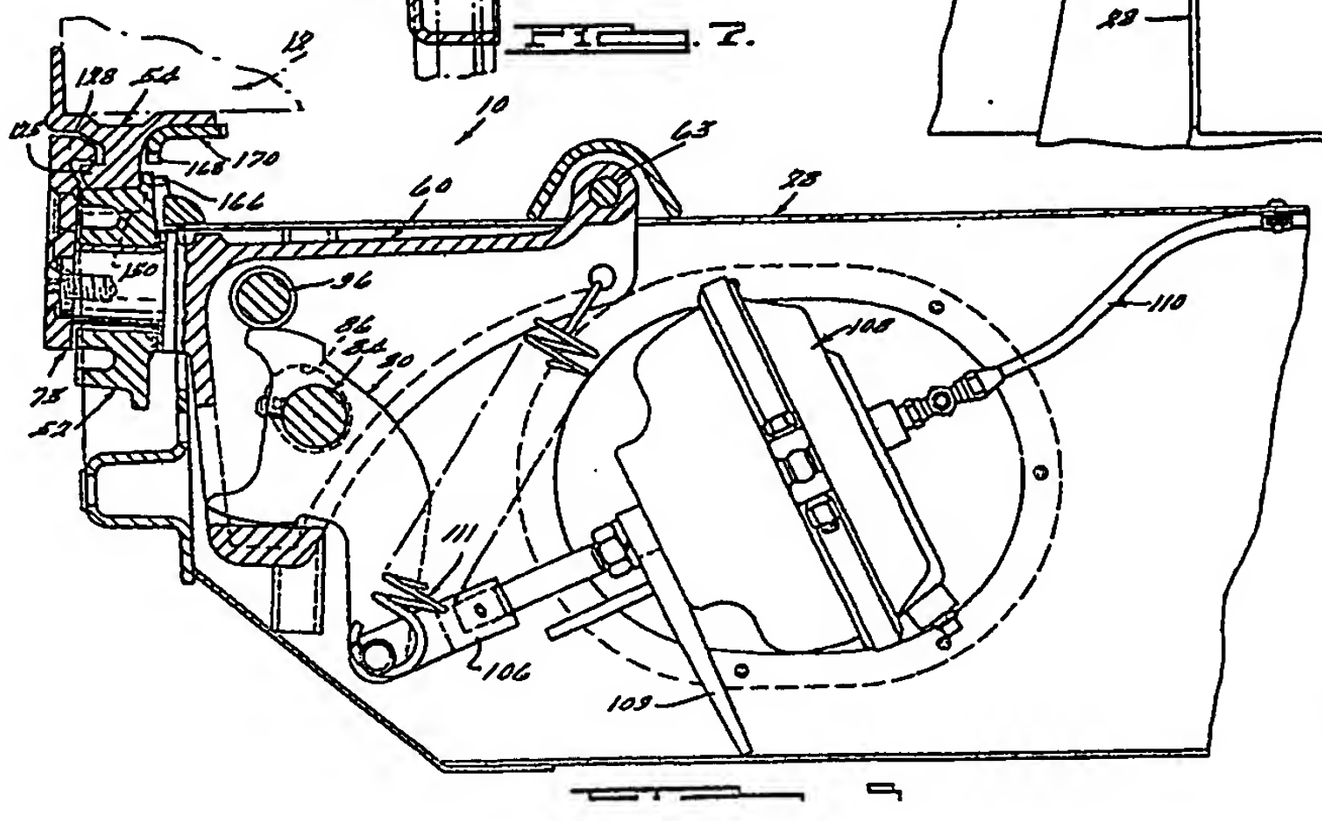

FIG. 9

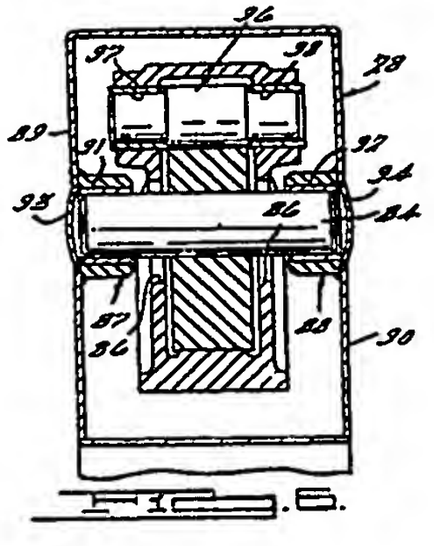

FIG. 6.

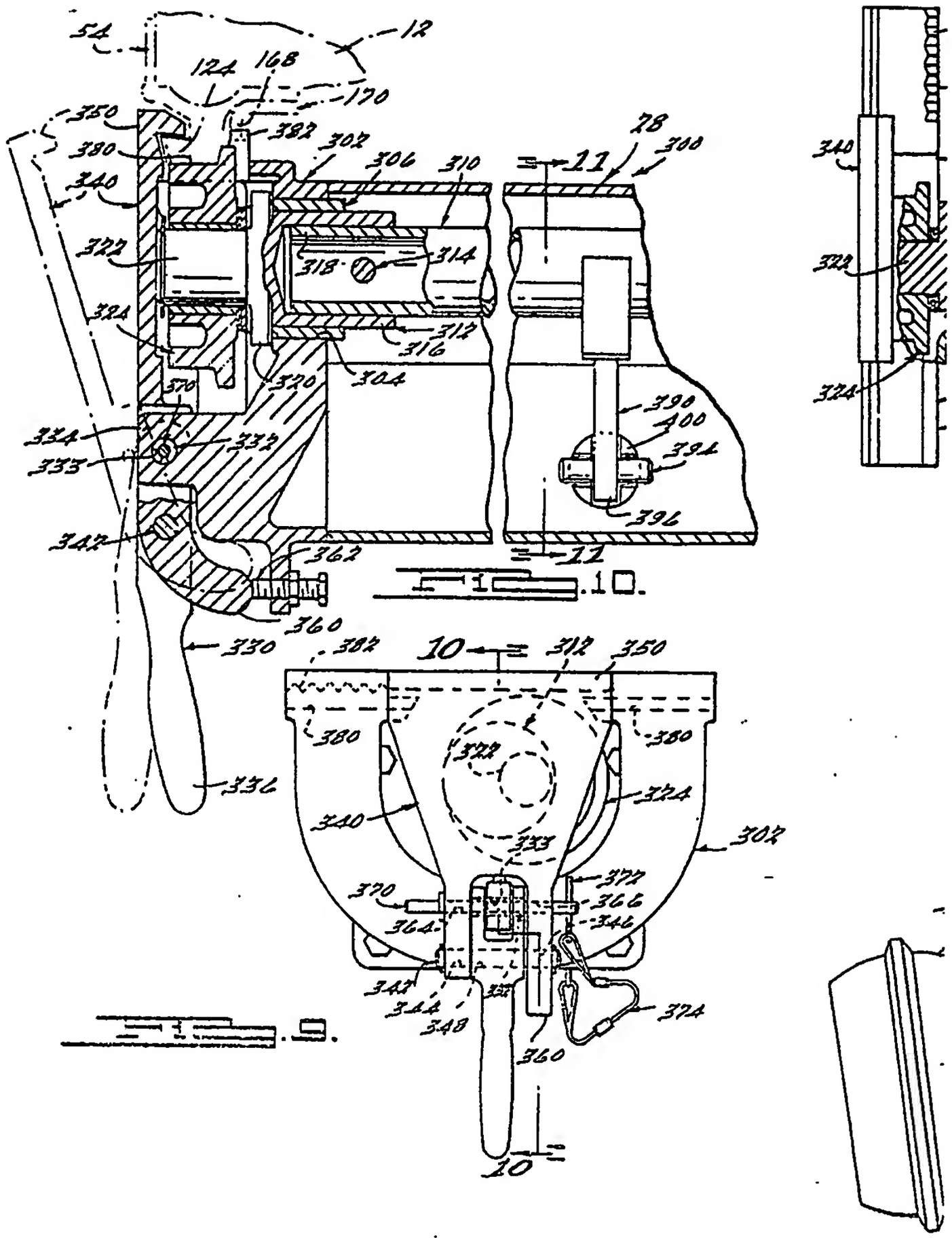
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FIG. 10.

FIG. 9.

937927 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 3

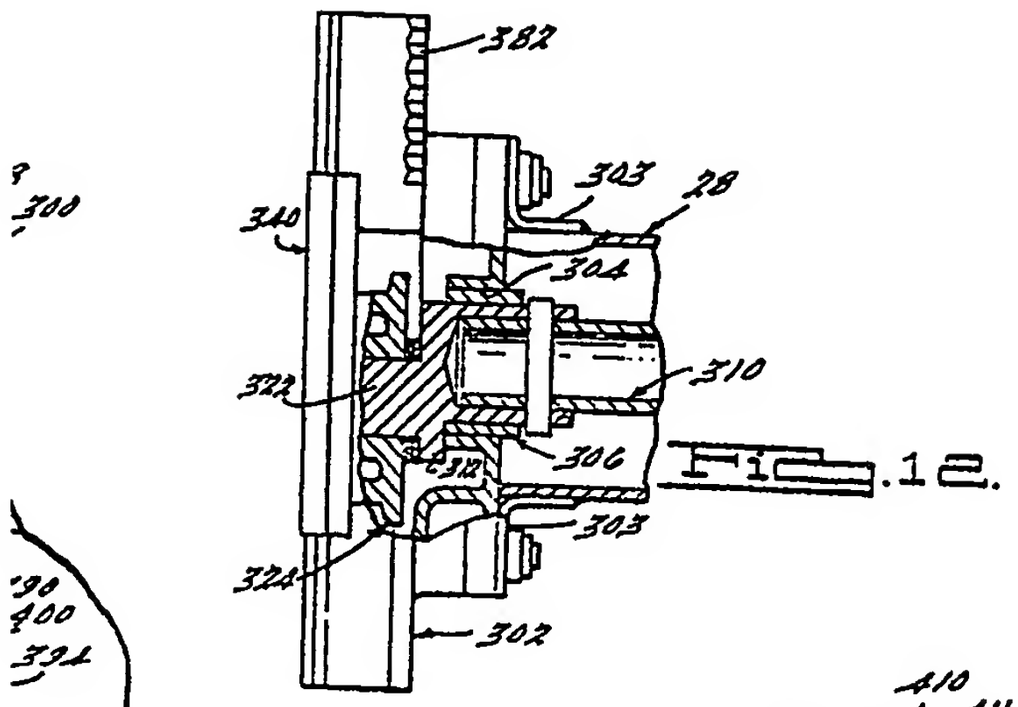

Fig. 12.

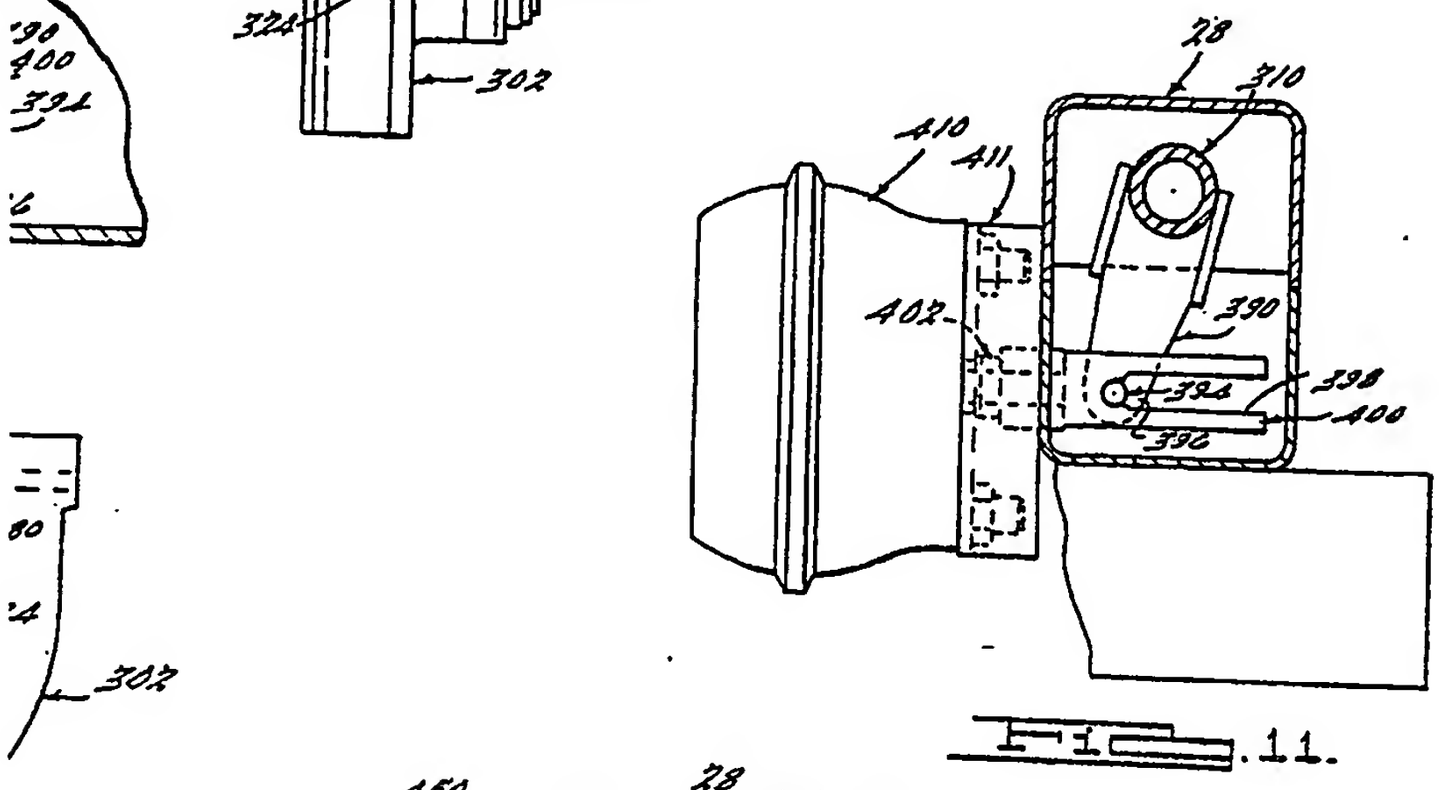

Fig. 11.

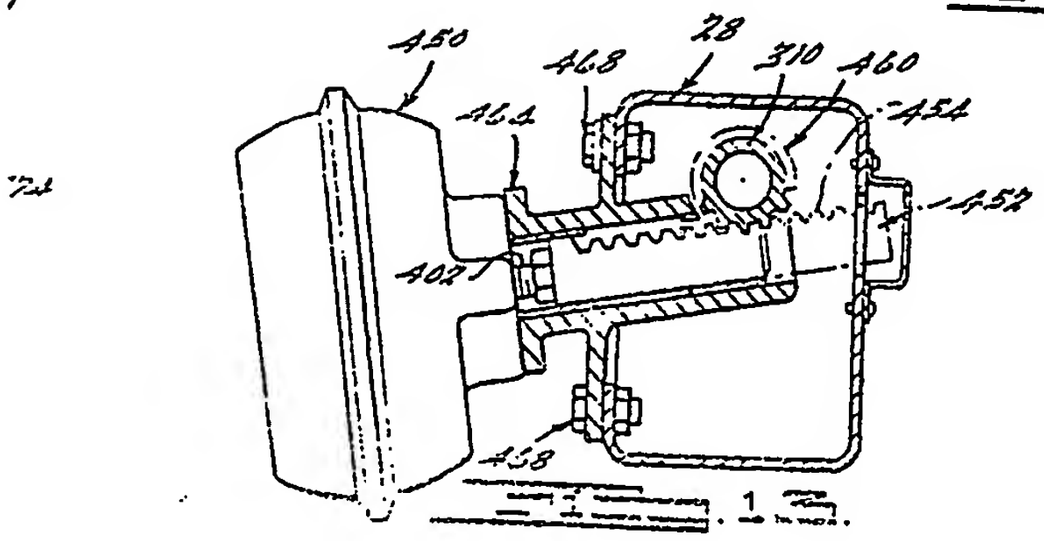

Fig. 13.

907927 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 3

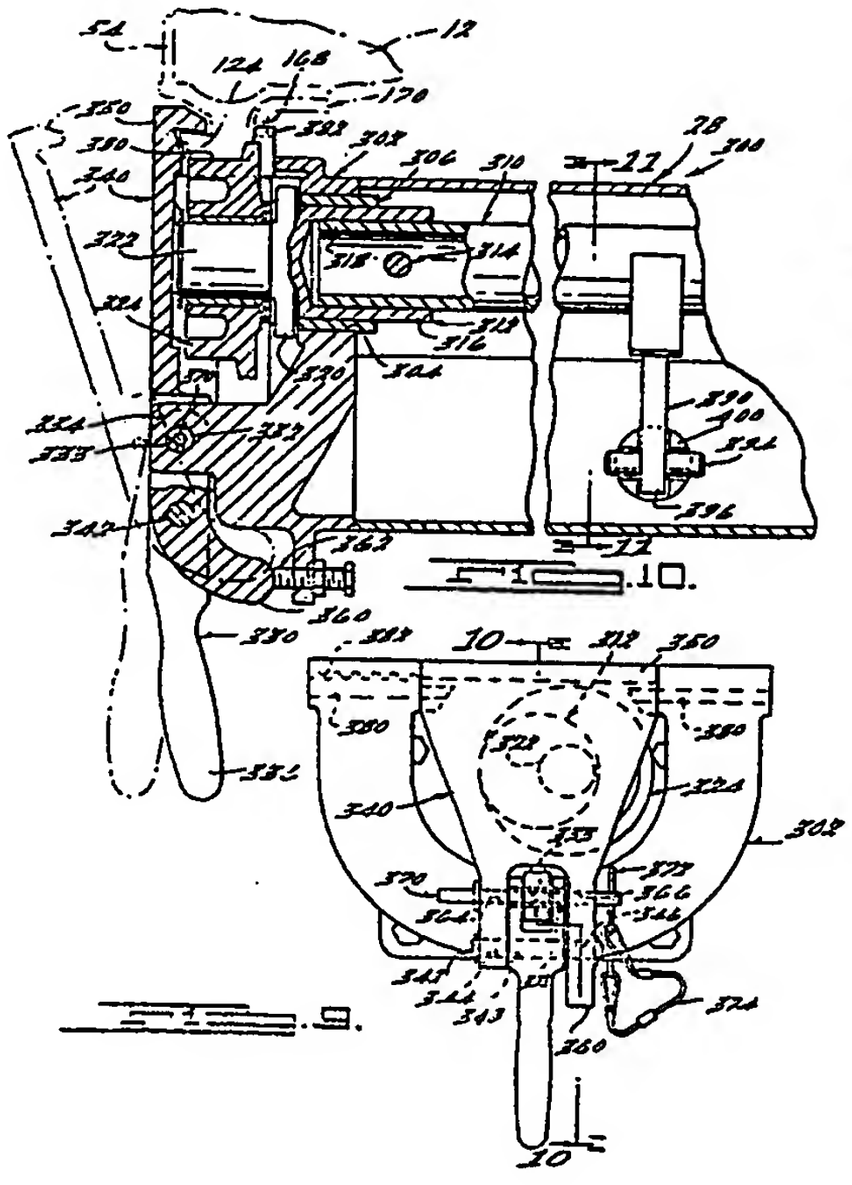

FIG.10.

FIG.9.

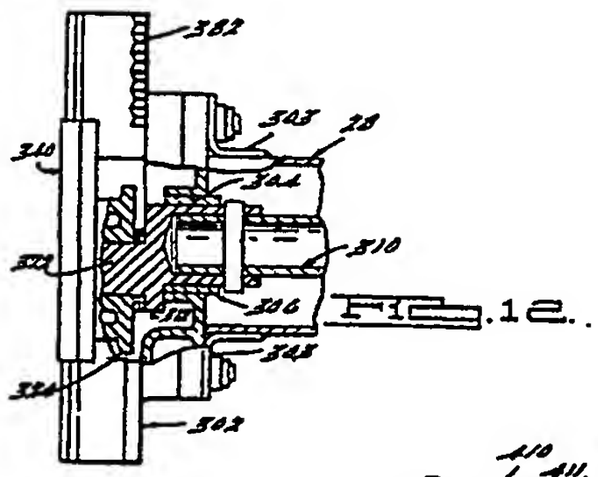

FIG.12.

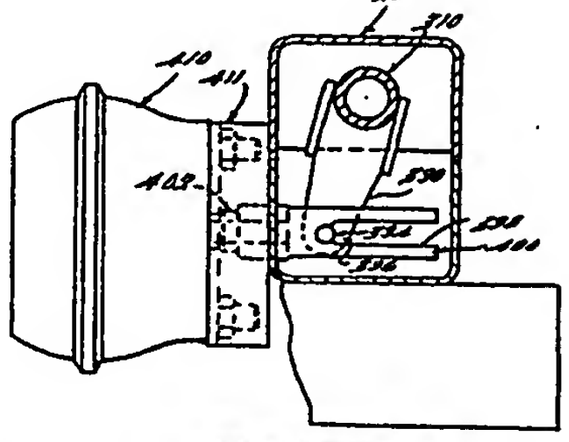

FIG.11.

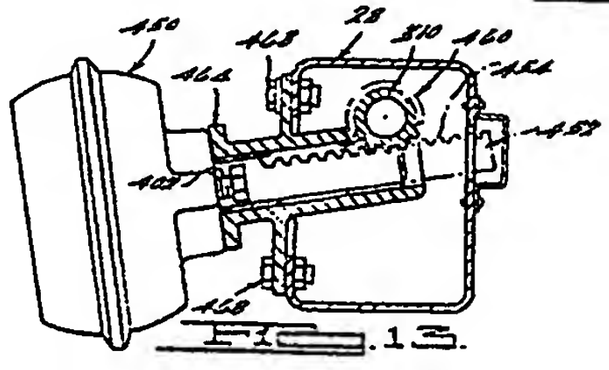

FIG.13.